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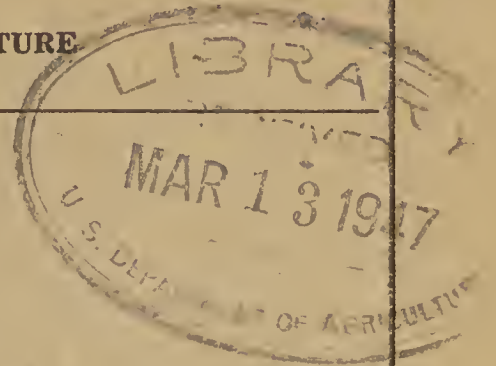
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GUAM AGRICULTURAL EXPERIMENT STATION
ISLAND OF GUAM

Under the supervision of the
UNITED STATES DEPARTMENT OF AGRICULTURE



REPORT OF THE
GUAM AGRICULTURAL EXPERIMENT
STATION

1922



Issued July, 1924



WASHINGTON
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1924

GUAM AGRICULTURAL EXPERIMENT STATION, ISLAND OF GUAM.

[Under the supervision of the Office of Experiment Stations, United States Department of Agriculture.]

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Washington, D. C.



July, 1924.

**REPORT OF THE GUAM AGRICULTURAL
EXPERIMENT STATION, 1922.**

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REPORT OF THE ANIMAL HUSBANDMAN IN CHARGE.

By C. W. EDWARDS.

During the year the station's activities continued to make definite progress, and results on the whole were satisfactory, notwithstanding inadequate funds and limited personnel. Climatic conditions were generally favorable to crop production. There were neither prolonged droughts nor severe storms, and a plentiful supply of green forage was available during all seasons for the livestock.

HORSES.

One purebred Morgan stallion was again kept at the Piti station for the purpose of improving the native ponies and producing horses of greater size and better conformation. Due to lack of labor and insufficient pasture area, it became necessary to abandon the plan, undertaken two years previous, of allowing a number of privately owned native mares to remain at the station until they were in foal.

CATTLE.

At the beginning of the year the station herd numbered 9 purebred Ayrshires, 51 grade Ayrshires, 1 grade Jersey, and 17 natives. The increase by birth numbered 13 male and 13 female grade Ayrshire calves, while the decrease through sale numbered 15 male and 1 female grades. One native cow and 2 grade male calves died. The following table shows the number of cattle of each class on hand at the close of the year.

Cattle on hand at the close of the fiscal year 1922.¹

Breed.	Number of bulls.	Number of cows.	Young stock.		Calves.		Total.
			Males.	Females.	Males.	Females.	
Ayrshires.....	2	4	1	1			8
Grade Ayrshires.....	2	17	2	15	9	13	58
Grade Jerseys.....		1					1
Natives.....		16					16
Total.....	4	38	3	16	9	13	83

¹ Males 3 years old or over are classed as bulls, heifers 3 years old or over as cows, calves 1 year or over as young stock.

In an effort to improve the native cattle, the grade bulls of the station were again loaned out for service, free of charge. Fifteen cows, which were brought in for the purpose, were bred to purebred sires, and eight grade males were disposed of to the public for use as breeders.

As a result of the work of upgrading the local cattle, begun by the station with the introduction of the first Ayrshire cattle during the latter part of the year 1912, Ayrshire grades are now fairly well established throughout the island. (Pls. I and II.) The dissemination of improved blood has been accomplished principally through disposal to the public of suitable grade males, cows in the immediate vicinity of the station only being brought in for service to the purebred sires.

In most countries it is considered poor practice to use grades for this purpose, but the arrangement is the best possible under present local conditions and facilities. Purebred stock is imported with difficulty and at considerable expense. The purebred mature bull is too large for range service with the small native cow,¹ and the average Chamorro is hardly likely to give purebred animals the care they need, since he knows little as yet concerning their proper management. The introduction of European purebred herd sires is undesirable mainly for these reasons.

The problem of improving the local cattle must be solved gradually, since it entails, along with the other work, a general education of the people to a realization of the necessity of providing improved pastures and of practicing better methods of care and management. Even the three-quarter bloods (three-fourths Ayrshire and one-fourth native) and higher grades must have improved forage and be kept comparatively free from ticks to develop properly.

¹ Among local cattle raisers it is the practice to allow the sire to range with the herd.

As a class the Chamorros are not consumers of fresh milk. Judging, however, from the requests recently received by the station for milk cattle—that is, for good milkers as compared with the average native cow—it is thought that the people are beginning to learn the value of fresh milk in their diet. Cattle raisers in general seem to realize, at least to a certain extent, the value of improved stock, being always ready to purchase grade males raised by the station for breeding purposes.

Cattle ticks.—The station is continuing its efforts to induce cattle owners to practice methods of tick control. With the elimination of the tick it might be possible to determine the causes responsible for decrease in size and milk yield of introduced European breeds of cattle.

Feeds and feeding.—The recently introduced grasses, Napier, Guatemala, and Japanese cane, furnished the bulk of the soiling roughage fed to the cattle at the Piti station during the year. All three varieties made good growth, are relished by the stock, and will probably make suitable green forage for Guam. They are being grown in both plat and field tests to determine their comparative feeding value and yields. It was observed in connection with the first cutting of Napier grass that some waste in feeding occurred unless the crop was cut at just the proper stage. The same is true to a less extent of Japanese cane, the stalks maturing early and becoming hard and unpalatable. The stalks of Guatemala grass remained succulent up to a comparatively much later stage in the growth of the plants. Inasmuch as Napier grass stooled readily with each cutting, giving a finer growth of stalk, there was less waste with each successive crop. Both Japanese cane and Guatemala grass stooled less profusely than did Napier grass and showed about the same habit of growth in this respect.

An experiment having for its object the determination of the effect on milk yield of feeding concentrates in addition to pasture and cut green forage was partly completed during the year. Half-blood (half Ayrshire and half native) Ayrshire cows Nos. 50, 54, and 15 were pastured on *Paspalum* and native grasses during the day and were stall fed fresh Para and other soiling grasses at night. Their entire green forage was nonleguminous and their grain ration consisted of copra meal fed in combination with ground corn and rice bran. In considering the results it should be noted that cow No. 15 was not in calf during practically one lactation period and that she became pregnant during the early stages of the other lactation period; likewise that cow No. 54 is of a very nervous temperament, which was especially noticeable at milking time when no grain was allowed. This condition probably accounted in part for the very low yield made by the animal for the lactation period during which no grain was fed. Cow No. 50 was considerably below normal weight at the close of the lactation period during which no grain was allowed.

In the following table one complete lactation period, during which concentrates approximating 1 pound of grain to 2 pounds of milk were fed, is compared with the following lactation period during which no concentrates were allowed.

Effect on milk yield of feeding green forage alone and in combination with concentrates.

Cow No.	Date of calving.	Ration.	Lactation period.		Milk yield.		Butterfat on green forage only. ¹	Month
			Date.	No of days.	Total.	Average daily.		
50---	July 31, 1921	Green forage plus concentrates.	Oct. 8, 1920, to July 10, 1921.	276	3,868.89	14.01	5.46 5.99 6.14	August. September. October.
	July 7, 1922	Green forage only	Aug. 5, 1921, to Mar. 21, 1922.	239	2,045.63	8.56	6.64 6.42 5.66 5.98 6.15	November December January. February. March.
54---	July 25, 1921	Green forage plus concentrates.	May 11, 1920, to Feb. 28, 1921.	294	2,196.39	7.47	4.65 4.63 4.25 4.82	July. August. September. October.
	July 6, 1922	Green forage only	July 29, 1921, to Mar. 5, 1922.	220	1,068.46	4.85	4.93 4.64 4.84 5.23 5.45	November. December. January. February. March.
15---	Dec. 4, 1921	Green forage plus concentrates.	Jan. 1, 1920, to Jan. 31, 1921.	397	2,849.45	7.17	5.46 5.09 5.35	December January. February.
	Oct. 18, 1922	Green forage only	Dec. 7, 1921, to Aug. 23, 1922.	260	1,683.40	6.47	5.46 5.54 6.00 6.28 7.15 8.50	March. April. May. June. July. August.

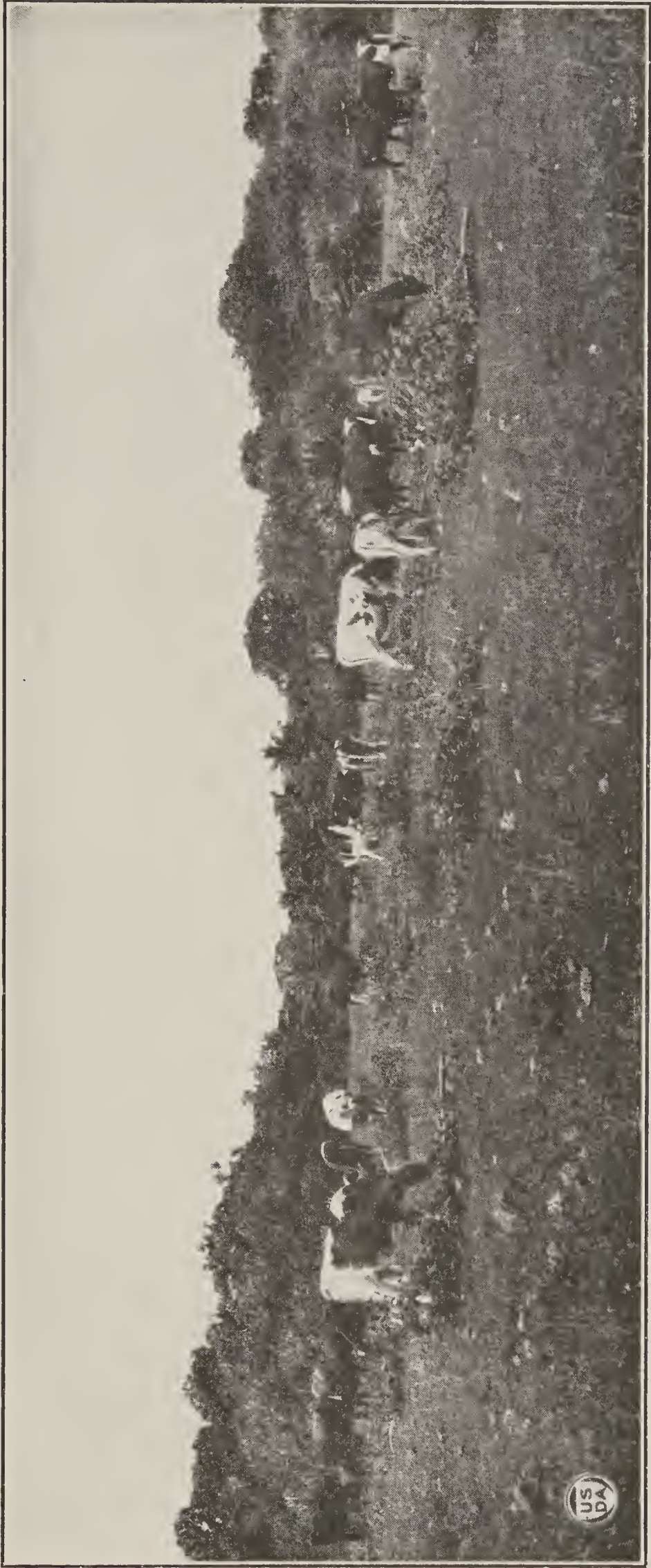
¹ Averages of analyses made approximately every seven days.

The milk yield of Guam grade cows is very low in comparison with that of dairy cattle in the States, but is decidedly better than that of the average native cow. In this respect the grade cow compares favorably with cows of the same or similar class in the Philippine Islands and other parts of the oriental Tropics. Most of the animals show a decided variation in milk yield from month to month, and it would therefore seem advisable in conducting comparative yield tests to compare whole lactation periods rather than parts of periods.

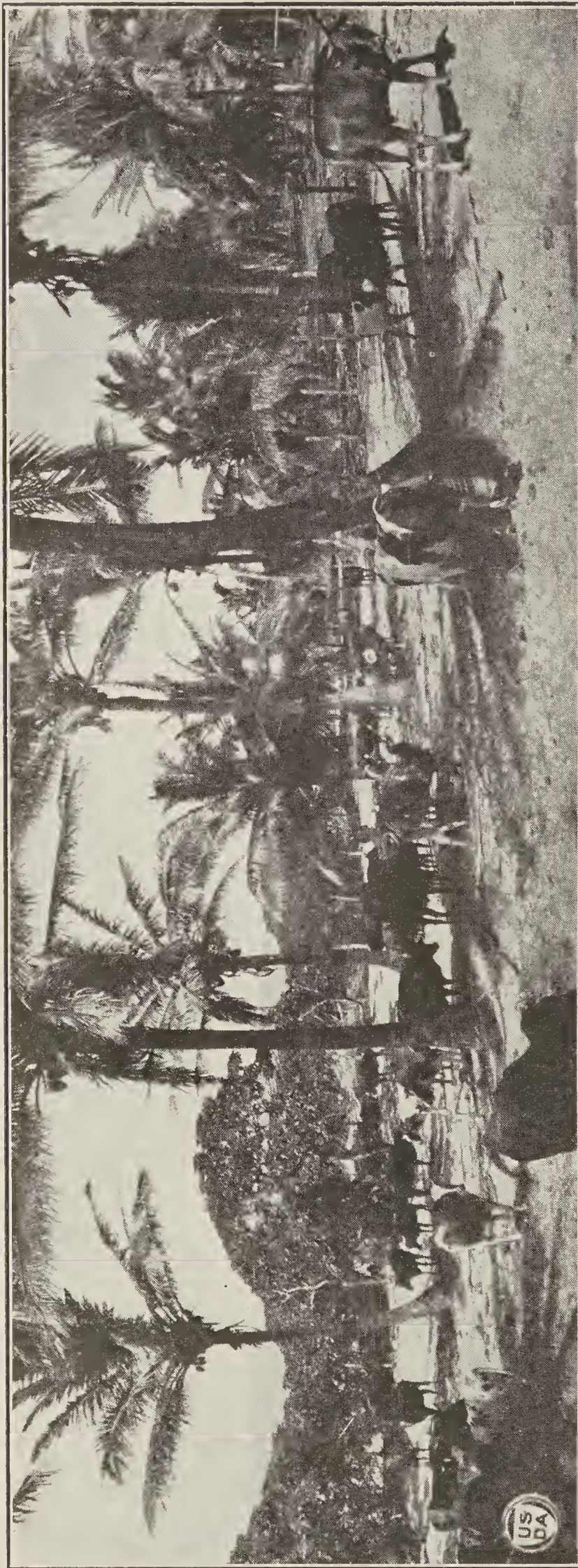
In order to give some idea of the production of the station Ayrshires, the milk and butterfat yield for one lactation period of one Guam raised cow, No. 41, aged 5 years and 10 months at the beginning of the lactation period, and of one imported cow, No. 5, aged 12 years at the beginning of the lactation period, is shown in the table on next page.

During the period covered, the cows were pastured on Paspalum and native grasses and were fed soiling grasses at night. In addition 1 pound of grain was allowed for each 2 pounds of milk produced.

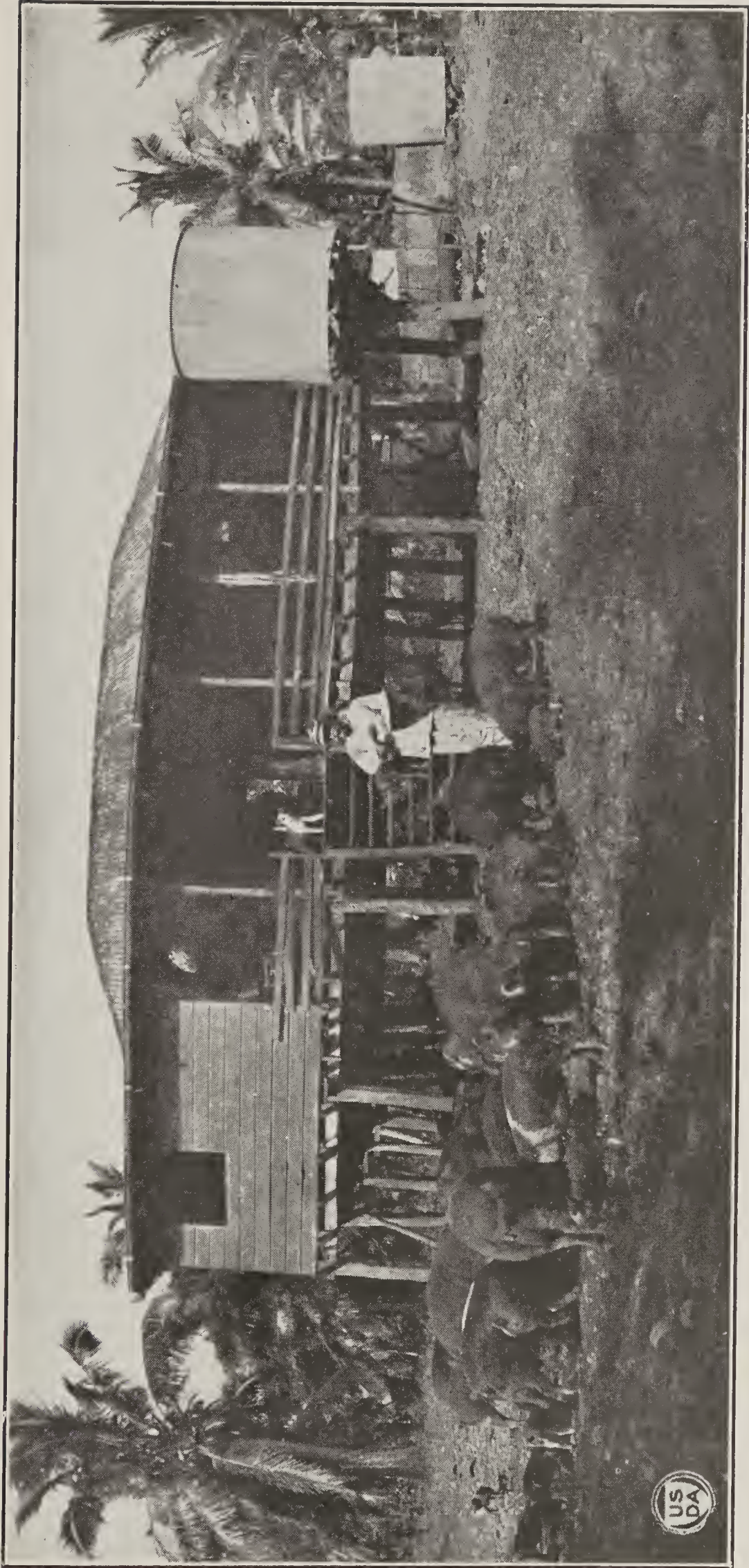
For the past two years or so copra meal has constituted one-third to one-half of the concentrate ration fed cattle. When used in combination with grain and grain products it makes an efficient and economical ration for both mature and young stock.



PORTION OF THE UBI HERD OF 300 GRADE AYRSHIRES.



PORTION OF THE TARAGUE HERD OF GRADE AYRSHIRES.



PORTION OF THE UPI HERD OF 80 GRADE BERKSHIRES.





Comparison of milk and butterfat yield for one lactation period of one Guam-raised and one imported cow.

Cow No.	Month and year.	Lacta- tion period.	Average daily milk yield.	Monthly milk yield.	Monthly yield of butterfat.	
		Days.	Pounds.	Pounds.	Per cent.	Pounds.
41 (Guam raised) ¹	December (11), 1920	20	18.64	372.88	4.00	14.92
	January, 1921	31	19.26	597.13	3.90	23.29
	February, 1921	28	16.46	460.75	4.62	21.29
	March, 1921	31	15.21	471.56	4.50	21.22
	April, 1921	30	14.75	442.63	5.25	23.24
	May, 1921	31	14.48	448.88	4.56	20.47
	June, 1921	30	12.01	360.44	5.20	18.74
	July, 1921	31	11.08	343.50	4.48	15.39
	August, 1921	31	10.17	315.38	5.18	16.34
	September, 1921	30	7.93	237.82	6.40	15.22
	October, 1921	31	6.55	203.01	6.00	12.18
	November, 1921	30	5.85	175.63	6.05	10.63
	December, 1921	31	4.71	145.88	6.40	9.34
	January, 1922	31	4.45	137.81	6.45	8.89
	February (28), 1922	28	3.58	100.19	6.10	6.11
	Totals and averages	444	11.00	4,813.49	5.27	237.27
5 (imported) ²	March, 1921	31	18.30	567.38	4.00	22.70
	April, 1921	30	18.12	543.56	3.90	21.20
	May, 1921	31	15.71	486.94	4.60	22.40
	June, 1921	30	12.71	381.38	4.25	16.21
	July, 1921	31	13.36	414.19	4.20	17.40
	August, 1921	31	12.30	381.38	4.68	17.85
	September, 1921	30	10.20	306.13	5.08	15.55
	October, 1921	31	8.72	270.38	5.03	13.60
	November, 1921	30	7.55	226.56	5.70	12.91
	December, 1921	31	5.97	185.19	5.47	10.13
	January, 1922	31	5.55	172.06	5.25	9.03
	February, 1922	28	3.58	100.31	6.05	6.07
	March, 1922	31	2.96	91.82	5.78	5.31
	April 12, 1922	12	2.70	32.38	5.75	1.86
	Totals and averages	408	9.84	4,159.66	4.98	192.22

¹ Calved Dec. 11, 1920.

² Calved Feb. 26, 1921.

SWINE.

Shy breeding in the grade sows was again manifest to some extent during the year. An attempt is being made to determine the cause of this condition. Last year the two imported purebred boars were apparently sterile, since privately owned native sows which failed to produce when bred to them gave litters when bred later to native boars. During the past year the fault in two cases seemed to be due also, to some extent at least, to shy breeding in the sows, while in four cases it was due to impotency in the boars. The grade sows were repeatedly bred to three imported purebred boars (two station boars and one belonging to a local rancher) without results. They were then turned out and allowed to range with the boar. After some time all of them farrowed, giving a small litter in each case. No difficulty was experienced in getting results when these sows were mated with a purebred imported boar, No. 271, which was purchased locally by the station in April, only one service in each instance being required. Evidently the breeding qualities of the other three sires are inferior. At first the trouble was attributed to the feeding of copra meal, but a change of ration did not remedy matters.

There has been very little evidence of sterility or shy breeding in the imported sows and boars. Experience shows that both purebred boars and sows are likely to be sterile or unreliable breeders for sev-

eral years following their importation. Of the three imported sows owned by the station, two failed to breed and the third was bred after being on hand for some time, but farrowed only one pig. Four purebred gilts which were imported last year by a local company have so far failed to come in heat.

Defective breeding in the imported boars may have been due to the method of handling. Boar No. 271, above referred to, has never shown evidence of sterility. Imported in February, 1920, at about 6 months of age, this animal was allowed free woodland range and fed sparingly. The four or five imported boars with which the station has had experience were fed for maximum growth in each case, although they were given plenty of range and were not overconditioned. It might be advisable to allow for a slower rate of growth with young imported stock, even at the sacrifice of a certain amount of size. Much more data will have to be obtained to admit of the drawing of definite conclusions along this line.

Some data relative to swine-breeding work at the station would seem to indicate that there is loss in fecundity, with respect to numbers of offspring per litter, in upgrading the native stock through successive crossing.

In an effort to continue the work of upgrading the native swine, the station has sold breeding stock to ranchers, loaned out one grade boar for public service, and bred a number of privately owned sows to the purebred boars. Results of this work are apparent throughout the island. (Pl. III.)

For the first time in a number of years no deaths occurred from kidney worm (*Stephanurus dentatus*) infection. Improvement is attributed to the rather general use of the portable colony house and run and to the practice of keeping the sow and litter, from farrowing time until weaning of the litter, in a pen having slat flooring.

The total increase by birth during the year numbered 7 females and 11 males. One grade gilt and 1 purebred boar were obtained through exchange for other stock. At the close of the fiscal year ended June, 1922, there were on hand 2 male Berkshires, 1 male and 4 female grade Berkshires (seven-eighths Berkshire, one-eighth native) 1 female grade Berkshire (thirteen-sixteenths Berkshire, three-sixteenths native), 6 male and 4 female grade Berkshire pigs (fifteen-sixteenths Berkshire, one-sixteenth native), and 2 male and 1 female grade Berkshire pigs (twenty-nine thirty-seconds Berkshire, three thirty-seconds native).

Ration for dry sows and for mature boars.—Two parts cooked breadfruit, 1 part polished (damaged) rice, and 1 part copra meal, together with 3 to 4 ounces per head of tankage daily, made a satisfactory ration for six dry sows during a period of 95 days, and for two mature boars during a period of 125 days.

Table scraps and coconut as a feed for swine.—For the past two years the local naval hospital has maintained a herd of 20 to 30 grade Berkshires at the Tumon farm. This herd has daily subsisted on table scraps from the hospital mess with approximately 1½ pounds of fresh coconut per 100-pound weight of animal, and Paspalum grass as a pasture. The coconuts were cut in half and fed from the shell. The animals kept in good condition, and the sows produced satisfactorily except in cases where they were allowed

to become too fat. In feeding this combination it would seem inadvisable to let the breeding stock become overconditioned.

POULTRY.

Breeding work for the production of a new variety or breed adapted to local conditions was first undertaken by the station in 1918, at which time the foundation stock consisted of selected native white hens (Pl. IV, fig. 1) and Single Comb Rhode Island Red cockerels. During the first two years the work was directed toward the improvement of the foundation stock, and in 1920 the actual work of cross-breeding began. During the year four crosses were made between hybrids only (Pl. IV, fig. 2) and two between natives and Rhode Island Reds. No white-plumaged specimens were produced in the first cross of hybrids, but some good white-feathered ones were obtained in the second generation. No deterioration in size of pullets and cockerels has been noticed to occur in the second generation. Among hybrids of both the first and second crosses some individuals show improvement over those raised during the previous season.

SINGLE COMB RHODE ISLAND RED VARIETY.

The Single Comb Rhode Island Red is the only purebred variety now kept by the station. The present flock originated from two small shipments received from the States in 1918. The imported hens were fine specimens, and although they did better than other varieties of imported hens, they were comparatively low producers. Steady improvement has been observed in this connection, however, particularly in individual production.

PUBLIC STOCK IMPROVEMENT WORK.

This station is the only agency for the distribution of breeding stock on the island. A few surplus Single Comb Rhode Island Red cockerels were sold for breeding purposes during the year, and over 130 settings of eggs were distributed to local poultry raisers. The demand for settings continues to be considerably in excess of the supply.

REPORT OF THE ASSISTANT IN AGRONOMY AND HORTICULTURE.

By JOAQUIN GUERRERO.

In agronomy particular attention was given to forage plants, rice, cassava, sugar cane, liming of soils, and rotation and continuous culture. The work in horticulture included mainly plant introductions, experiments with fruit and vegetables, seed and plant distribution, the continuation of work with coconuts and pineapples, and care of the station orchard.

FORAGE CROPS.

Special emphasis was again placed on forage crops. The introduction and propagation of different varieties of improved forage grasses are of prime importance to Guam, since it is not always

practicable to import feeds and pasture grasses, and soiling crops must be depended upon to maintain the livestock.

GRASSES.

In addition to Paspalum and Para, the value of which has already been demonstrated by the station, Napier (*Pennisetum purpureum*), Guatemala (*Tripsacum laxum*) (Pl. V, fig. 1), and Japanese cane (*Saccharum officinarum*) (Pl. V, fig. 2) seem well adapted to island conditions. The calculated yields per acre, in three cuttings, of these and other grasses were as follows: Napier grass—first cutting 51 tons, second 68.5 tons, third 50.5 tons, average 56.67 tons; Guatemala grass—first cutting 36 tons, second 35.5 tons, third 35 tons, average 35.5 tons; Japanese cane—first cutting 70.5 tons, second 87.5 tons, third 43.5 tons, average 67.17 tons; *Pennisetum setosum*—first cutting 30.15 tons, second 5.9 tons, third 7.6 tons, average 14.55 tons; Sudan—first cutting 8.25 tons, second 4.7 tons, third 4.8 tons, average 5.92 tons; and Guinea—first cutting 20.1 tons, second 14.7 tons, third 5.7 tons, average 13.5 tons.

For comparison on a larger scale, approximately one-third acre each of these grasses was planted in field A on October 29. Napier made the most rapid growth of the three, followed by Guatemala. Japanese cane made very slow growth, due apparently to the previous treatment given the plat. Paspalum had been grown on the cane plat for the past few years and Para on the Guatemala and Napier plats. Presumably the after effects of the Paspalum were largely responsible for the poor showing made by the Japanese cane.

The soil on which the test was made is a heavy lowland clay loam comparable to that of most of the lowlands of the island. Work of determining the adaptability of Napier and Guatemala grass and Japanese cane to other types of soils was begun during the year. For the most part such work must be done through the aid of co-operators, and under local conditions it can not be carried on without a sufficient field or extension force. The same grasses, grown from seed distributed by the station within the last two years, made a good showing on a river flat where the soil is a sandy loam and subject to overflow during the rainy season. Guatemala grass and Japanese cane also did well in another locality where the soil is of a light sandy nature, underlain by limestone. The latter is characteristic of much of the low coast-land areas of the northern part of the island.

Para grass (*Panicum barbinode*).—In order to test the effect on yield of growing legumes with Para grass, three-fourths of an acre of Para, planted October 28, was divided into three equal plats, two of which were intercropped with cowpeas and *Crotalaria juncea* planted November 18, and the third was left to serve as a check. Due to heavy, continuous rains, both legumes made a poor stand. The intercropped plat gave only a slight increase in forage yield.

In continuation of work dealing with the various methods of planting Para, an area of native grass (*Andropogon aciculatus*) was planted with Para on October 30. No preparation was given the soil and the cuttings were set in holes made with a pointed stick. The results showed this method of propagation to be impracticable, since the Para grass was not able to compete in any degree with the native grass.



FIG. 1.—PEN OF NATIVE WHITE HENS.



FIG. 2.—GRADE PULLETS FROM HALF-BLOOD MATINGS. (ONE-HALF RHODE ISLAND RED X ONE-HALF NATIVE ON BOTH DAM AND SIRE SIDE.)



FIG. 1.—GUATEMALA AND NAPIER GRASS 130 DAYS AFTER PLANTING.
(GUATEMALA IN FOREGROUND.)



FIG. 2.—JAPANESE CANE 130 DAYS AFTER PLANTING. (PLAT FORMERLY
DEVOTED TO PASPALUM.)

Further observations on the pastures of the Cotot district show that when Para is overgrazed it is replaced by mumutong chiva (*Ageratum conyzoides*) and batunes (*Hyptis capitata*), and that these in turn are supplanted by native grasses.

Rhodes grass (*Chloris gayana*).—A small test of this grass was started at the station on January 25. The plat was harvested when the seed was mature (June 30) and yielded at the rate of 8 tons of green forage to the acre. About 6 pounds of the seed was broadcasted on a light sandy soil at the Atkins-Kroll plantation at Tarague. The grass may be of local adaptation as a pasture grass, although it is very inferior to leading coarse forages as a soiling crop. It stooled sparingly on the test plat, but spread rapidly by reseeding.

Pearl millet (*Pennisetum glaucum*).—Pearl millet, planted August 9, 1921, flowered September 28, and produced its first fruit on October 12. The crop was harvested November, 8, 1921, and yielded 4,200 pounds of forage and 487½ pounds of seed per acre. This grass is not considered of special value under the local conditions.

Teosinte (*Euchlæna mexicana*).—Planted July 26, teosinte headed two months later. The crop was harvested November 16, yielding at the rate of 7,400 pounds of green forage per acre. The plants averaged 5 to 8 feet in height and tillered very sparingly.

SORGHUMS (HOLCUS (ANDROPOGON) SORGHUM).

During the year 26 varieties of both saccharine and nonsaccharine sorghums were received from the Oklahoma Agricultural Experiment Station. These were planted in small test plats on January 28. Results of the one cutting made during the year are shown in the following table:

Results of sorghum variety test started January 28, 1922.

Variety.	Date blossomed.	Date of first mature head.	Date of harvest.	Height.	Yield per acre.	
					Grain.	Green forage.
				Inches.	Pounds.	Tons.
Shallu.....	Mar. 17, 1922	Apr. 18, 1922	May 6, 1922	79.4	3,225.0	4.0
Sourless cane.....	Mar. 23, 1922	do	do	97.4	3,600.0	12.5
African millet.....	Mar. 29, 1922	Apr. 19, 1922	do	85.2	5,000.0	13.5
Bishop's kafir.....	Mar. 28, 1922	Apr. 17, 1922	do	63.6	1,525.0	3.5
White milo.....	Mar. 22, 1922	Apr. 12, 1922	Apr. 21, 1922	61.2	2,300.0	4.5
Darso.....	Mar. 18, 1922	Apr. 17, 1922	May 6, 1922	69.2	2,450.0	5.0
Brachet kaoliang.....	Mar. 14, 1922	Apr. 12, 1922	Apr. 21, 1922	68.2	2,550.0	6.3
Spur feterita.....	Mar. 23, 1922	do	do	71.4	2,300.0	10.0
Standard feterita.....	Mar. 14, 1922	do	do	69.0	1,537.5	6.0
Schrock kafir.....	Mar. 24, 1922	Apr. 17, 1922	do	63.0	3,037.5	5.0
Dwarf hegari.....	Mar. 10, 1922	Mar. 29, 1922	do	53.6	825.0	4.0
Blackhull kafir.....	Mar. 24, 1922	Apr. 11, 1922	do	63.8	2,962.5	3.9
Dwarf kafir.....	Mar. 28, 1922	Apr. 17, 1922	do	63.8	1,762.5	4.0
Early kafir.....	Mar. 24, 1922	Apr. 18, 1922	May 6, 1922	83.0	1,475.0	4.5
Dawn kafir.....	Mar. 18, 1922	do	Apr. 21, 1922	63.4	1,950.0	6.3
Kafir sorgo.....	Mar. 24, 1922	Apr. 21, 1922	May 6, 1922	85.2	2,062.5	7.0
Honey cane.....	Mar. 29, 1922	Apr. 15, 1922	do	85.8	450.0	11.5
MacLean's sorgo.....	Mar. 24, 1922	Apr. 16, 1922	do	101.4	2,025.0	8.3
Club Head sorgo.....	Mar. 22, 1922	do	do	81.4	1,812.5	9.6
Sumac.....	Mar. 28, 1922	do	do	80.6	2,350.0	7.0
Seeded Ribbon cane.....	Mar. 22, 1922	Apr. 10, 1922	do	69.2	1,175.0	4.7
Orange cane.....	Mar. 29, 1922	Apr. 21, 1922	do	80.2	662.5	3.2
Dwarf Ashburn.....	Mar. 23, 1922	Apr. 20, 1922	do	73.2	1,850.0	7.5
Red Amber cane.....	do	do	do	104.0	3,412.5	8.5
Black Amber cane.....	Mar. 18, 1922	Apr. 9, 1922	do	109.8	1,912.5	5.7
Yellow milo.....	Mar. 18, 1922	do	do	72.0	1,112.5	3.5

African millet gave the highest yield of both grain and fodder, closely followed by Sourless cane. Shallu or Egyptian wheat, which is characterized by rather large spreading heads containing hard, glossy seeds, has given better results lately than in former tests. Seed of this variety is very much in demand as a poultry feed.

LEGUMES.

Cover crops.—Cover crop investigations were continued along the same general lines as outlined in former reports. Of velvet beans, cowpeas, mungo beans, soy beans, pigeon peas, *Crotalaria juncea*, and Patani beans, grown for comparative purposes, pigeon peas, Patani beans, and *C. juncea*, in the order named, made the most efficient cover crops. During the latter part of the year, velvet beans, cowpeas, pigeon peas, and *C. juncea* were grown on a poorly drained heavy clay loam to determine which would efficiently cover the ground for the longest period of time. All crops except pigeon peas succumbed to the heavy continuous rains occurring during the early stage of growth. This would seem to indicate that the growing of pigeon peas on a heavy clay loam enables them to withstand excessive rainfall to a greater degree than is true of the other crops tested. The experiment will be repeated.

Small bean test.—In this test were included only legumes of the genus *Phaseolus*. Mungo beans invariably failed to make a satisfactory cover crop in regard to the length of time they occupied the ground. Usually they put out the densest growth of foliage and made a very good cover crop between the comparatively short period of flowering and maturing. Mungo beans are very much liked by the Chamorros, and the plant is generally grown as a catch crop.

Two small bean variety tests were completed during the year. In both tests a marked difference in growth was noted between the crop grown during the rainy season and that grown during the dry season. In the former instance the plants were taller, developed much more foliage, and consequently covered the ground more efficiently than was true of the crop grown in the dry season. The heavier yield of grain was, however, produced during the dry season. The following table summarizes the results.

Results of small bean variety test.

Variety.	Yield of seed per acre.		Average yield per acre.
	Planted June 28, 1921.	Planted Dec. 21, 1921.	
	Pounds.	Pounds.	Pounds.
Hawaiian mungo.....	1,325.0	1,262.5	1,293.8
Green mungo.....	650.0	797.5	723.8
Black mungo.....	1,875.0	1,475.0	1,675.0
Urd bean.....	1,275.0	1,587.5	1,431.3
<i>Phaseolus calcaratus</i>	1,050.0	1,150.0	1,100.0
Rice bean.....	1,125.0	1,250.0	1,187.5
Adzuki (buff) bean.....	725.0	762.5	743.8
Adzuki (red) bean.....	662.5	350.0	506.3

Velvet beans (*Stizolobium* spp.).—In a test of 10 varieties of velvet beans, Black Mauritius was found to make the best cover and green manure crop, producing the heaviest foliage and covering the ground for the longest period of time. Yokohama and Lyon gave the largest yields of grain. The earliest maturing varieties invariably produce the lightest foliage. The following table gives the results of the test:

Results of variety test of velvet beans planted June 27, 1921.

Variety.	Date blossomed.	Date of first mature pods.	Date of first harvest.	Length of vine.	Acro yield of seed.
				<i>Inches.</i>	<i>Pounds.</i>
Bush.....	Aug. 21, 1921	Oct. 28, 1921	Nov. 8, 1921	47.4	1,587.5
One-Hundred Day Speckled.....	Aug. 29, 1921	Nov. 4, 1921	Dec. 5, 1921	94.8	1,100.0
Georgia.....	do	Nov. 3, 1921	do	86.0	862.5
Alabama.....	do	Nov. 6, 1921	do	91.0	1,025.0
Lyon.....	Sept. 12, 1921	Nov. 8, 1921	do	92.4	2,650.0
Florida.....	Sept. 7, 1921	Nov. 25, 1921	Dec. 31, 1921	120.2	487.5
Chinese.....	Sept. 16, 1921	Nov. 26, 1921	Dec. 17, 1921	100.4	1,975.0
Osceola.....	Sept. 18, 1921	Nov. 30, 1921	Dec. 31, 1921	100.6	937.5
Yokohama.....	Sept. 12, 1921	Nov. 12, 1921	Dec. 5, 1921	99.0	2,287.5
Black Mauritius.....	Nov. 3, 1921	Nov. 6, 1921	Dec. 31, 1921	162.0	1,050.0

Cowpeas (*Vigna sinensis*).—The cowpea is more generally grown throughout the island than any other variety of cover crop, owing to its double use as a food for human consumption and as a green manure crop. The vine is readily chopped and turned under with the native plow. Both vine and fruit are eaten by rats unless control measures are practiced. An efficient means of poisoning these pests at the station is arsenic mixed with grated coconuts.

In a comparative test of six varieties of cowpeas, started July 26 and harvested October 13, 1921, Iron made the most vigorous growth, attaining a vine length of 96 inches, with Brabham a close second, 94.8 inches. Brabham and New Era each yielded 8.5 tons of green forage per acre, with Iron, Victor, Groit, and Red following in the order named.

Soy beans (*Glycine soja* or *Soja max*).—After repeated attempts to grow soy beans at the station some success is being had in this line. Further trials with the different varieties must be made, however, before definite conclusions can be drawn regarding the adaptability of the crop to Guam conditions. Due to their scanty foliage, soy beans do not make an efficient cover or green manure crop. The vines shed most of their leaves before the fruit begins to mature. In a test of eight varieties which was completed during the year black and brown Biloxi gave the best average results, yielding 3,618.8 and 2,225 pounds, respectively, of grain per acre, and producing the heaviest growth of vine. Barchett and Peking followed with a yield of 1,450 and 1,262.5 pounds, respectively.

Pigeon peas (*Cajanus indicus*).—The variety test of the previous year was continued, and on March 9, 1922, the first ratoon crop was harvested. New Era made the highest yield, 1,900 pounds per acre, followed by Columbia and a variety from the British West Indies, which produced 1,187.5 and 1,125 pounds, respectively, per acre. Unfortunately all the plants were killed by high north winds and no forage yields were obtained.

Miscellaneous legumes.—Other legumes tried during the year included vetch (purple and Oregon varieties), *Crotalaria juncea*, chick-peas, kudzu, and clovers. Both varieties of vetch were planted in drills or rows on February 2, 1922, and made good growth until they reached a height of 20 to 26 inches and started to flower. Many of the plants then began to die. A few of the surviving plants were transplanted, but without avail. A shipment of *Crotalaria* seed was received during the year from the Porto Rico station. This legume made excellent growth, but had a decided tendency to lodge and proved to be a shy bearer. Caterpillars usually destroyed the seed before it had a chance to mature, and on a two-hundredth-acre plat barely enough seed was obtained to replant the area. Another lot of *Crotalaria*, planted on July 20, produced its first blossoms on September 7 and matured its first fruit on November 25. The crop was cut for green forage on December 21 and yielded at the rate of 15 tons to the acre.

Chick-pea seeds, obtained from the United States Department of Agriculture, were planted August 9, but produced only about 40 per cent of a stand. When about 18 inches high the plants began to die. None of them flowered. Heavy continuous rains probably accounted for their failure.

Biennial yellow, white sweet, sour, bur, button, and southern bur clovers were also received from the Bureau of Plant Industry, United States Department of Agriculture, during the year and planted July 26. A good stand was obtained in each case, but the plants died later, bur clover alone reaching the flowering stage. Failure may have been due to the heavy rains falling during a part of the growing season, although the beds were raised sufficiently high to permit of good drainage.

Kudzu did not make as good a growth as it did last year. The plant is evidently the small leaf variety which is used by the Japanese for making cloth and for ornamental purposes. Effort is being made to obtain propagating material of the large leaf or forage variety of this plant.

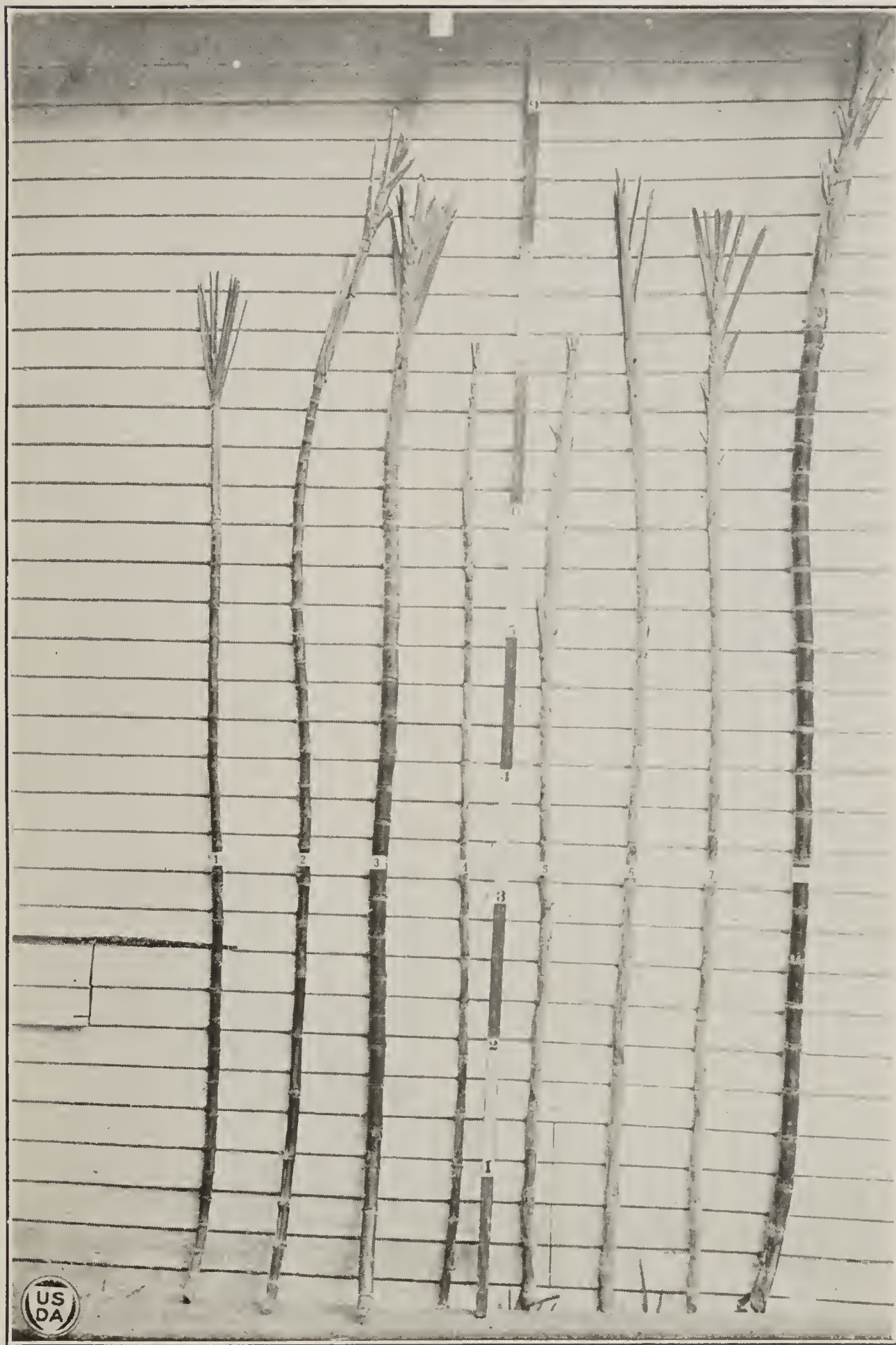
RICE (*ORYZA SATIVA*).

On the whole a better yield of rice was obtained and a larger area was planted by the farmers this year than has been the case in many years. Acre yields in the vicinity of the station were estimated at 10 to 20 cavans² of clean paddy.

Upland rice.—The varieties Mangasa and Iloilo were planted on a small area at the beginning of the rainy season, but the crops were destroyed by insects. Although upland rice is grown in considerable quantity in the Philippines, all attempts to grow it in Guam have been unsuccessful. Failure is attributed to growing the crop out of season, and at a time when pests, particularly the rice bug of India (*Leptocorisa varicornis*), are very prevalent.

Fertilizer tests.—The rice fertilizer experiment was continued under the same plan as in previous years, the work again being conducted on a cooperative basis. Plat No. 7, to which ammonium sulphate and acid phosphate were applied, gave the highest yield of clean,

² One cavan equals 2.75 bushels.



LOCAL AND IMPORTED VARIETIES OF SUGAR CANE. (1) RAYAO, (2) NETI, AND (3) GAIMUT, NATIVE VARIETIES; (4) UBA OR JAPANESE CANE, (5) CAYANA-10, (6) UBA OR JAPANESE CANE, AND (7) YONTANZAN, IMPORTED VARIETIES; AND (8) AGAGA, NATIVE VARIETY.

unhulled paddy. This was also the case last year. Plat No. 8, which received ammonium sulphate alone, gave the highest yield of straw.

CASSAVA (*MANIHOT UTILISSIMA*).

Variety and methods of planting and propagation tests were made on a fairly extensive scale for both experimental purposes and to provide feed for the station swine herd. Approximately one acre was cleared and planted to cassava, one-third being planted with each variety (white, yellow, and native), and the plantings were made a month apart. The land was not plowed, and dibbling was resorted to. The first plat was planted to white cassava on November 1, the second to yellow cassava on December 1, and the third to native cassava on January 1. The yields per acre were 2.4, 9.08, and 5.8 tons, respectively, which are low compared with those of former tests in which the ground was plowed and otherwise well prepared before planting. Unless the soil is in good friable condition it should be plowed or disked preparatory to the growing of cassava.³ In the test with white and yellow cassava, whole stalks as well as cuttings were used as seed, both being dibbled. An increase of 67 per cent in the yield of roots was had from the whole stalks of the white cassava and of 33 per cent from those of the yellow variety. It has been observed that a better stand is had during the dry weather if the whole stalks are placed in the ground and covered completely than is the case when they are placed in a slanting position and only partly covered. No difference in this respect was observed during the rainy season.

SUGAR CANE (*SACCHARUM OFFICINARUM*).

The station is conducting a test with local and certain imported varieties of sugar cane to determine their comparative yields (Pl. VI). The results of the first cutting were as follows: Native varieties, Agaga and Gaimut, planted December 23, 1920, cut February 17, 1922, yield 48 and 51 tons, respectively; Rayao, planted December 23, 1920, cut February 16, 1922, yield 25.5 tons; and Neti, planted November 27, 1920, cut February 16, 1922, yield 62 tons; imported varieties Cayana-10, Uba, and Yontanzan, planted June 30, 1920, cut June 29, 1922, yield 11, 17, and 28.5 tons, respectively, per acre.

The native farmer objects to the imported cane because of the firm adherence of the leaf sheath to the stalk and the hard texture of the canes. Owing to the latter characteristic, milling is difficult with the present crude machinery in use. Agaga, which is grown in small patches around the home principally for consumption of the raw stalk as "dulce," is one of the largest of the local varieties in height and size of stalk. The canes are fairly soft in texture and purplish red in color.

Rayao is characterized by the yellow and green stripes of its stalk, which is small, soft in texture, and reputed to be very sweet. In size of cane, Gaimut resembles Agaga. The stalk is of light green color. Neti resembles Rayao in height and size of stalk. Neti is light green in color and the hardest in texture of any of the

³ The prevailing practice of clearing the ground with a fosiño is not recommended.

local varieties. Both Rayao and Neti are most commonly used for field planting.

The imported varieties of sugar cane stool more readily than do the local varieties, and, because of the hard texture of the stalk, are less damaged by rats. Uba cane seems to resemble Japanese cane closely.

LIMING OF SOILS.

The pot experiment on liming mentioned in the last annual report⁵ was concluded this year. The object of this experiment, begun in November, 1920, was to determine the effect of lime in varying amounts on land which has been under cultivation for some time and on newly broken native grassland. The experiment was considered necessary because land which has been in native grass for some years fails to produce satisfactorily, with respect to most crops, until after it has been under cultivation for some time. One application of lime was made to pots of both new and old soils at the rate of 1, 2, 4, 8, and 16 tons per acre. Corn was the only crop grown in the pots. At the completion of growth of each crop the plants were chopped finely and mixed thoroughly with the soil from the three pots in the series. The pots were then refilled with the mixture. The fourth and fifth crops in the experiment were completed during the year. With the new soil the yield of the limed pots was greater in each case than that of the check pots, the increase being due apparently to the residual effect of the lime. The results of the test are given in the following table:

Effect of lime on old and new soils of Guam.

Crop No.	Check.		Rate of application per acre.									
			One ton.		Two tons.		Four tons.		Eight tons.		Sixteen tons.	
	Height.	Weight.	Height.	Weight.	Height.	Weight.	Height.	Weight.	Height.	Weight.	Height.	Weight.
Old soil:	<i>Ins.</i>	<i>Gms.</i>	<i>Ins.</i>	<i>Gms.</i>	<i>Ins.</i>	<i>Gms.</i>	<i>Ins.</i>	<i>Gms.</i>	<i>Ins.</i>	<i>Gms.</i>	<i>Ins.</i>	<i>Gms.</i>
1.....	36.00	61.67	34.33	69.67	35.67	81.00	35.00	78.00	35.33	77.33	23.33	25.00
2.....	29.33	20.00	26.00	13.67	25.33	38.33	25.67	39.67	25.33	49.00	38.33	101.33
3.....	48.00	102.67	49.00	149.00	50.33	153.00	51.00	164.33	48.33	147.33	53.33	158.00
4.....	41.67	71.67	38.00	83.00	42.67	61.67	39.33	82.33	33.33	70.33	37.67	41.00
5.....	38.50	66.00	39.50	72.67	41.00	65.00	43.00	98.67	38.50	67.00	42.00	63.67
Average.....	38.70	64.40	37.37	77.60	39.00	79.80	38.80	92.60	36.16	82.20	38.93	77.80
Average increased yield due to liming.....				13.20		15.40		28.20		17.80		13.40
New soil:												
1.....	28.67	59.67	33.67	76.67	38.33	73.00	31.00	58.33	30.33	75.00	16.00	21.50
2.....	31.33	45.67	26.67	17.67	32.33	61.33	39.33	77.67	35.33	41.67	47.33	183.67
3.....	48.67	149.67	51.67	143.00	46.00	148.00	49.67	203.67	57.33	267.33	55.00	188.00
4.....	37.33	72.33	43.00	98.67	51.67	77.00	49.67	128.00	48.33	124.33	42.67	80.33
5.....	40.00	50.33	41.67	111.00	45.00	128.67	48.00	125.33	44.00	127.33	57.33	90.33
Average.....	37.20	75.53	39.34	89.40	42.67	97.60	43.53	118.60	43.06	127.13	43.67	112.77
Average increased yield due to liming.....				13.87		22.07		43.07		51.60		37.24

⁵ Guam Sta. Rpt. 1921, p. 22.

The results seem to indicate that lime would very materially benefit newly plowed native grassland, and to a certain extent old soil. Judging from the results, it is thought that applications at the rate of 4 tons to the old soil and 8 tons to the new soil were the most efficient.

ROTATION AND CONTINUOUS CULTURE EXPERIMENT.

During the year two crops were completed in this experiment, representing the second and third seasons' work. Due to unfavorable weather conditions and to the prevalence of pests at the time the crops were maturing, only fair results were obtained in each case. Both young and mature pods of cowpeas were considerably damaged by rats, and corn was injured by the European cornstalk borer. Rotated plats, however, showed some increase in yield over the unrotated.

PLANT INTRODUCTIONS.

A comparatively large number of seeds and plants were received for trial planting during the year. The introduction included varieties of *Dioscorea alata*, *D. latifolia*, pejibaye, Penang taro, Colacasia, Trinidad dasheen, molasses grass, Jaraguáy grass, and peaches from the Bureau of Plant Industry, United States Department of Agriculture; strawberry guava, shaddock, papaya, tomato, and white oleander from the Hawaii Agricultural Experiment Station; and Ceylon alfalfa, mabolo (*Diospyros discolor*), chico (*Achras sapota*), duhat (*Eugenia* sp.), and lanzónes (*Lansium domesticum*) from the Philippine Islands. All of the material made a good start except the pejibaye seed which failed to germinate. Plants of both chicos and lanzónes from the introductions are making good growth in various districts throughout the island.

FRUIT INVESTIGATIONS.

Fruit investigations were confined to the keeping of the station orchard in good condition and to the introduction and distribution of various kinds of improved fruits adapted to island conditions. Various methods of vegetative propagation and disease control were also studied.

Citrus.—For about three months during the dry season the citrus orchard was allowed to lie fallow, and weed growth was kept down by occasional diskings. At the end of the period cover crops were planted. The trees responded well to the treatment. All were pruned and sprayed. The ground, especially low land, should not be allowed to lie fallow during the rainy season because of soil erosion at this time and the difficulty of keeping down the weeds.

Two introduced orange trees bore this year for the first time. As is often the case with varieties of oranges introduced into the Tropics, the fruits did not turn yellow upon ripening, but remained green. They were of fair size, rough surface, very acid, rather fibrous, and contained few seeds and only a medium quantity of juice. The fruits were decidedly inferior to the best varieties of so-called native oranges.

Strawberry.—In February, 1920, about 400 Everbearing strawberry plants were introduced into the island and planted in the garden. These did very well at first, producing two light crops of good quality, but at vining time they were attacked by a fungus.

New plantings of vigorous, apparently healthy propagating material from the old bed made a good start but were attacked by the disease at the time the runners appeared.

Mabolo.—During the early part of the year a mabolo tree (*Diospyros discolor*), planted in 1911, yielded a crop of 110 fruits weighing 78 pounds. This tree made poor yields in 1920 and 1921.

Mango.—Most of the Saipan trees at the station made comparatively heavy yields during the year. Trees of the Carabao variety continue to be shy bearers. With only one exception, these trees have failed to make even a fair yield for many years.

Pineapples.—Both the fertility and the crown and sucker tests were completed during the year. In the fertility test where the rows were 100 feet long, 50 feet of each, constituting a plat, was planted to Smooth Cayenne and the rest to the Thorny Red (probably Red Ceylon) variety.

The following table shows the effect of fertilizer on yield:

*Effect of fertilizers on yield of four crops of two varieties of pineapples.*¹

Treatment.	Total yield per acre of Smooth Cayenne variety.	Total yield per acre of Thorny Red variety.	Treatment.	Total yield per acre of Smooth Cayenne variety.	Total yield per acre of Thorny Red variety.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
Check.....	8.214	1.399	Bone meal, 1,500 pounds per acre.....	11.337	4.939
Sodium nitrate, 400 pounds per acre.....	9.729	5.123	Acid phosphate, 745 pounds per acre.....	11.351	4.715
Ammonium sulphate, 300 pounds per acre.....	11.765	5.415	Manure, 12,000 pounds per acre.....	8.619	4.149

¹ The experiment is being repeated with the exception that the acid phosphate plat has been eliminated and additional rows are being treated with lime and with sulphur.

In the crown and sucker tests each plat consisted of one row 100 feet in length. The object of this test was to determine the difference in time of fruiting from plantings of suckers and crowns. The rows planted with suckers of Smooth Cayenne bore, on the average, 123.33 days earlier than did those planted with crowns; and the average yield from sucker plantings was 37.2 per cent above those of the crown plat. Suckers of both the Thorny Red and the native varieties made distinct gains over crowns in regard to yield and fruiting time. The table below gives the comparative yield of crowns and suckers from three varieties of pineapples.

Comparative yield from plantings of crowns and suckers of three varieties of pineapples.

Variety.	Part of plant used.	Length of time from planting to first harvest.	Yield per acre.			
			First crop.	Second crop.	Third crop.	Total.
		<i>Days.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Cayenne.....	{ Crowns.....	383	0.238	6.09	0.96	7.288
	{ Suckers.....	307	1.720	5.14	1.09	7.95
Thorny.....	{ Crowns.....	422	.944	3.69	1.63	6.264
	{ Suckers.....	207	2.163	6.61	1.91	10.683
Cayenne.....	{ Crowns.....	406	.296	5.29	3.39	8.976
	{ Suckers.....	361	.320	7.85	.52	8.69
Native.....	{ Crowns.....	403	.609	3.31	1.84	5.759
	{ Suckers.....	336	.606	4.07	1.89	6.566
Cayenne.....	{ Crowns.....	468	-----	1.63	.85	2.480
	{ Suckers.....	219	.654	7.53	.94	9.124

GARDEN VEGETABLE DEMONSTRATIONS.

Due to shortage of funds, only a small area was devoted to garden work.

Tomatoes.—In the selection work with the Cristobal variety of tomato, two plantings were set out in the garden and one was made in the regular field plats. Practically all were failures, due to unfavorable weather conditions, but principally to the presence of the root-knot disease. Sufficient seed material was obtained from the plantings, however, to enable the work to be continued. In an effort to combat the root-knot disease both seeds and seed beds are being treated with formalin, and field plats are being limed and rotated. Other varieties of tomatoes tried during the year included Red Pear, Stone, Self-Pruning, Dwarf Champion, San Jose, Canner, and Hawaiian hybrid. These plantings were destroyed by heavy rains which fell early in the growing period.

Lettuce.—In the variety tests with Mignonette, Iceberg, and May King, Mignonette alone formed heads. Selection work with this variety is being conducted in the hope of obtaining a head-producing strain. The first generation produced only a few heads. Selection was made from these plants. Seeds are seldom produced during the rainy season, as the plants usually die then before blooming.

SEED AND PLANT DISTRIBUTION.

Through the efforts of the Governor of Guam a comparatively large shipment of teak (*Tectona grandis*) seeds was received early in the year from the Philippine Bureau of Forestry. A part of this seed was used for planting in the public forests, and the rest was distributed by the station through the schools. Each packet of seed bore mimeographed instructions relative to treatment for quick germination and the subsequent care of the seedlings. At the time it was ready for transplanting the teak, together with other economic seedlings furnished by the station, was set out on Arbor Day.

The general distribution of seeds and plants for the year included 2,690 packets of vegetable seeds, 2,813 economic plants, 3,240 rooted cuttings of ornamentals, 492 pineapple suckers, 87 banana suckers, 1,610 taro plants, 87 sorghum heads, 50 pounds of leguminous seeds, and 65 gunny sacks of propagating material of improved grasses.

EXPERIMENTS WITH COCONUTS.

Fertilizer and cover-crop tests with coconuts, begun in May, 1918, were continued cooperatively on the Atkins-Kroll plantation at Tarague.

Fertilizer test.—Plats Nos. 1, 2, and 3, each containing 48 trees, is annually given an application of ammonium sulphate (150 pounds), acid phosphate (200 pounds), and ammonium sulphate and acid phosphate in combination (150 and 100 pounds, respectively). So far no material difference can be noted between the treated and the check plats. The trees are just coming into bearing.

Cover crops.—The cover-crop experiment was completed during the year. In this experiment, as originally planned, the crops used included velvet beans, cowpeas, and jack beans planted in plats Nos. 1, 5, and 6, respectively. On October 28, 1919, Patani beans

(*Phaseolus lunatus*) were added. The cowpeas made a fairly efficient cover crop for a short time only; the jack beans became affected in the early stages of growth with a disease resembling mosaic. The Patani beans, closely followed by the velvet beans, made the most efficient crop as to density of growth and length of time the ground was efficiently covered. In this and other plantings of velvet and Patani beans, in which the main crop ripens during a period of abundant moisture, it has been observed that a volunteer crop comes on in time to continue the control of weeds and other growth.

REPORT OF THE EXTENSION DIVISION.

By C. W. EDWARDS.

Owing to a reduction in the station's appropriation, the services of W. J. Green as extension agent had to be dispensed with early in the fiscal year. Extension work has been very successful from the beginning, March, 1919, and the results clearly show the extent to which it is essential to the agricultural development of the island. The average Chamorro farmer is slow to adopt new methods, and extensive cooperation and the dissemination of agricultural information can therefore be brought about only through personal contact, close supervision of work in the field, and the offering by the station of frequent advice and encouragement.

Through the generous assistance of the governor in extending financial aid from island government funds, the extension work was continued on a reduced scale. Mr. Nelson had general supervision of the work and a former supervisor of the Sumay Boys' and Girls' Clubs was appointed as assistant.

ADULT DEMONSTRATION WORK.

Under this phase of the extension work efforts were confined mainly to assisting farmers to secure and use to good advantage improved plants, seeds, and breeding stock, and to encouraging the use of improved farming implements and better methods of farming generally.

DISTRICT FAIR.

The only district fair of the year was held at Merizo on July 3 and 4. On the whole, the exhibits showed an improvement over those of the previous year both in number and quality. In the agricultural and livestock departments improved products and livestock were the principal features, the exhibits being the result of distributions by the stations of seed and plant material and improved breeding stock. Members of the boys' and girls clubs offered the largest total number of exhibits, and their work showed better preparation and was of better quality than was true of the general exhibits. The number of entries and cash prizes in each department were as follows: Agriculture, 145 entries, 52 cash prizes; livestock, 124 entries, 56 cash prizes; boys' and girls' clubs, 233 entries, 74 cash prizes; trades and industries, 23 entries, 70 cash prizes; domestic arts, 112 entries, 90 cash prizes; domestic science (cooking), 60 entries, 60 cash prizes.

BOYS' AND GIRLS' CLUB WORK.

This phase of extension work continues to be very popular. The total enrollment for the year was 1,994 members, and the total number completing the work and submitting reports was 1,072. The club activities supervised included work with corn, beans, gardens, root crops, pigs, and poultry. Mimeographed instructions in the form of leaflets were issued each month to club members. The total value of products raised during the year was \$13,743.54.

CLUB FAIRS.

Club fairs are considered of great assistance in the club work. The fairs are held in the various districts. Only members of the clubs are allowed to compete and only those products which they have raised or produced are exhibited.

The crop exhibits were housed in the school building and the livestock in a near-by building especially constructed for the purpose by club members. In general the exhibitors made a creditable showing. Especially worthy of mention was the exhibit of garden products made by the garden club members.

The second club fair was held in the Asan district on September 24. In this event efforts were confined to matters pertaining to the exhibit proper, no sports or other forms of amusement being featured. Among the exhibits of especial note were Rhode Island Red chickens and grade Berkshire pigs.

Both at this and at the Sumay fairs the members of the station staff acted as judges and awarded the premiums. After the prizes were awarded the judges gave short talks to the club members. The following table shows the number of entries made and the prizes awarded at both fairs:

Number of entries made and prizes awarded at the Sumay and Asan club fairs.

Club.	Sumay fair.		Asan fair.	
	Number of entries.	Number of cash prizes awarded.	Number of entries.	Number of cash prizes awarded.
Corn.....	20	6	7	6
Bean.....	28	18	59	18
Garden.....	92	30	44	30
Root crop.....	12	12	21	12
Copra.....	38	10	12	10
Pig.....	9	16	6	20
Poultry.....	29	14	16	18
Total.....	238	106	165	114

SCHOOL GARDENS.

In the 11 outlying districts school gardening is required as part of the regular course of studies for boys. The work is in direct charge of the teacher, usually the principal of the school. The gardens are frequently inspected by the extension assistant and instructions relative to methods of planting and cultivation and the making of reports are given. During the year 501 pupils were enrolled in the garden course.

METEOROLOGICAL OBSERVATIONS, 1922.

The following table summarizes data of meteorological observations during the year ended June 30, 1922:

Condensed meteorological data for the year ended June 30, 1922.

Month.	Temperature.					Total pre- cipi- tation.	Atmos- pheric pres- sure (month- ly mean).	Wind.	
	Maxi- mum.	Mini- mum.	Mean maxi- mum.	Mean mini- mum.	Month- ly mean.			Prevailing direction.	Average hourly veloc- ity.
1921.	°F.	°F.	°F.	°F.	°F.	Inches.	Inches.		Miles.
July.....	91.5	71.0	88.34	76.57	82.45	7.10	29.749	Northeast.....	3.79
August.....	89.0	74.0	86.06	76.25	81.16	14.78	29.727	South.....	4.94
September.....	91.5	74.0	87.55	76.19	81.87	15.40	29.749	West.....	2.90
October.....	90.5	74.5	86.53	76.38	81.45	10.82	29.728	Northeast.....	3.89
November.....	90.5	75.0	88.14	77.44	82.79	9.07	29.756	East.....	6.09
December.....	89.5	73.0	87.55	76.46	82.00	5.14	29.744	do.....	7.23
1922.									
January.....	89.5	72.5	87.25	75.70	81.48	1.77	29.768	Northeast.....	8.24
February.....	89.0	72.0	86.51	74.32	80.41	4.25	29.785	do.....	6.78
March.....	89.5	72.0	87.32	75.50	81.41	6.85	29.794	do.....	6.70
April.....	91.0	75.0	89.25	77.10	83.17	2.32	29.798	East-northeast.....	6.69
May.....	91.0	75.0	88.40	77.10	82.75	7.28	29.781	East.....	5.54
June.....	91.0	74.0	88.68	76.79	82.74	8.66	29.767	do.....	3.73

ERRATA.

[GUAM AGRICULTURAL EXPERIMENT STATION REPORT 1921.]

Page 1, line 25, change “lungworm (*Strongylus paradoxus*)” to read “strongylus (*Hæmonchus contortus*).”

Page 2, line 23, change “be resistant” to “have so high a resistance.”

Page 3, line 10, change “intestinal” to “internal.”

Page 3, next to last line, strike out “or cattle.”

Page 4, line 17, add after words “proved satisfactory,” the words “for pigs of weanling age.”

Same page, line 39, “The animals” should read “Breeding animals.”

Page 17, line 14, change “stable” to read “staple.”

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